USER'S GUIDE

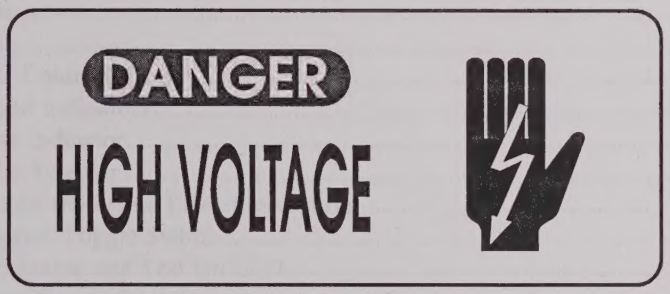
Model: OCCM

Part Number: AS14-1475

HUBBELL

HIPOTRONICS®
THE MEASURE OF A LEADER

ROBINSON INSTRUMENTS



DEC 15 1994

WARNING! This publication describes a product engineered and designed to measure or operate with HIGH VOLTAGES. Accordingly, maximum safeguards have been built into the equipment and the best safety techniques possible are described in the unit's operating instructions. These instructions caution the user to exercise great care when using certain controls at appropriate points in the operating procedures. In addition to following these written warnings, the operator of this equipment is strongly advised to maintain safety consciousness. The following rules are particularly relevant and must be followed at all times.

- ◊ GROUND THE SYSTEM BEFORE CONNECTING INPUT POWER
- ◊ DISCONNECT POWER BEFORE UN-GROUNDING THE SYSTEM
- ◊ NEVER APPROACH OR TOUCH A POTENTIALLY LIVE HIGH VOLTAGE CIRCUIT WITHOUT SOLIDLY CONNECTING AN APPROPRIATE GROUND CONDUCTOR FIRST.

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About the User's Guide

This user's guide describes the Hipotronics digital series of oil dielectric test sets. It is intended to provide a simplified reference for users of this equipment, allowing the quick, safe, and efficient use of the unit's features.

Information in this user's guide applies to both the OC60D and OC90D models of digital oil dielectric test sets. Specific information for the model purchased includes a diagram of the front panel, a PCB assembly diagram, a parts list, and a schematic diagram.

Before You Begin

It is assumed that the user has a basic understanding of electrical equipment and the major functions to be performed by the specific unit discussed in this manual. ***Only trained, qualified personnel should operate this equipment.***

Organization of this User's Guide

This user's guide is divided into four major sections, including:

- **General Information**, which discusses the features and specifications of the digital models of oil dielectric test sets, and provides a description of the functions performed by each of the controls and indicators on the front panel.
- **Setting Up the Equipment**, which provides instructions for preparing the unit for test operations.
- **Operating the Equipment**, which provides instructions for performing test operations and for using the optional OCPC Automatic Controller.
- **Performing Special Operations**, which provides procedures for recalibrating the unit, diagnosing problems, performing maintenance, and for using the optional OCCM Calibrator.

Related Publications

An outline of the functions, features, and specifications of the Oil Dielectric Test Sets is provided in the Hipotronics product catalog. Additional information is also contained in the American Society for Testing Manuals (ASTM) Standards D1816 and D877.

General Information

This section acquaints the user with the major features and specifications of the Hipotronics digital series of oil dielectric test sets and the functions performed by each of the controls and indicators on the front panel.

Features and Specifications

The Hipotronics digital oil dielectric test sets are designed to test the breakdown voltage of insulating liquids used in the high voltage field as the insulating and cooling medium in cables, transformers, oil circuit breakers, and similar apparatus. These units meet all ASTM requirements for performing the tests described in ASTM Standards D877 and D1816, and IEC 156.

The digital series of oil dielectric test sets consist of Models OC60D and OC90D. They are fully automatic, providing output voltage ranges of 0-60 kV and 0-90 kV, respectively.

Figure 1 lists the specifications unique to each model. Note that the output voltages indicated are from center-tapped transformers. For example, the OC60D provides maximum output of 60 kV RMS between two bushings, 30 kV per bushing to ground.

MODEL	OUTPUT	METER RANGE (kV ac Scale)	RATE OF RISE
OC-60D	0-60 kV RMS	3 ½ Digit LED Display	500/2000/3000 VPS (automatic)
OC-90D	0-90 kV RMS	3 ½ Digit LED Display	500/2000/3000 VPS (automatic)

Figure 1 *Digital Oil Dielectric Test Sets*

Input

All models operate from an input of 115 volts ac, 50/60 Hz, single phase, 15 amps, (or optionally 220/240 V, 5 A) and are equipped to perform tests according to ASTM, IEC, and VDE standards. All models feature an automatic rate of rise of 500, 2000 and 3000 volts per second, with manual dwell at each voltage level. Other features include a memory voltmeter and an overload switch. The following test cells (oil cups) are options available for use with the Hipotronics digital oil dielectric test sets.

TC/DE Test Cell

This test cell is used with oil dielectric test set Model OC60D for testing at 3000 volts per second, in accordance with ASTM Standard D877. A specification sheet for the TC/DC test cell is provided with the item.

TC/VDE Test Cell

This test cell is used with oil dielectric test set Model OC60D for testing at 500 volts per second, in accordance with ASTM Standards D877 and D1816. A specification sheet for the TC/VDE test cell is provided with the item.

IC/IEC Test Cell

This test cell is used with the oil dielectric test set Model 0C60D for testing at 2000 volts per second, in accordance with the IEC-156 standard.

TC/CE90 Test Cell

This special combination test cell is used only with oil dielectric test set Model OC90D. Interchangeable DE and VDE electrodes allow testing at 3000 volts per second or 500 volts per second, in accordance with ASTM Standards D877 and D1816. A specification sheet for the TC/CE90 test cell is provided with the item.

Controls and Indicators

A diagram of the front panel for units in the digital series of oil dielectric test sets is displayed in Figure 2. Refer to this diagram, as well as to the front panel itself, when reading the description of the controls and indicators. ***Note that the front panel displayed in Figure 2 may differ slightly from that of the model purchased.***

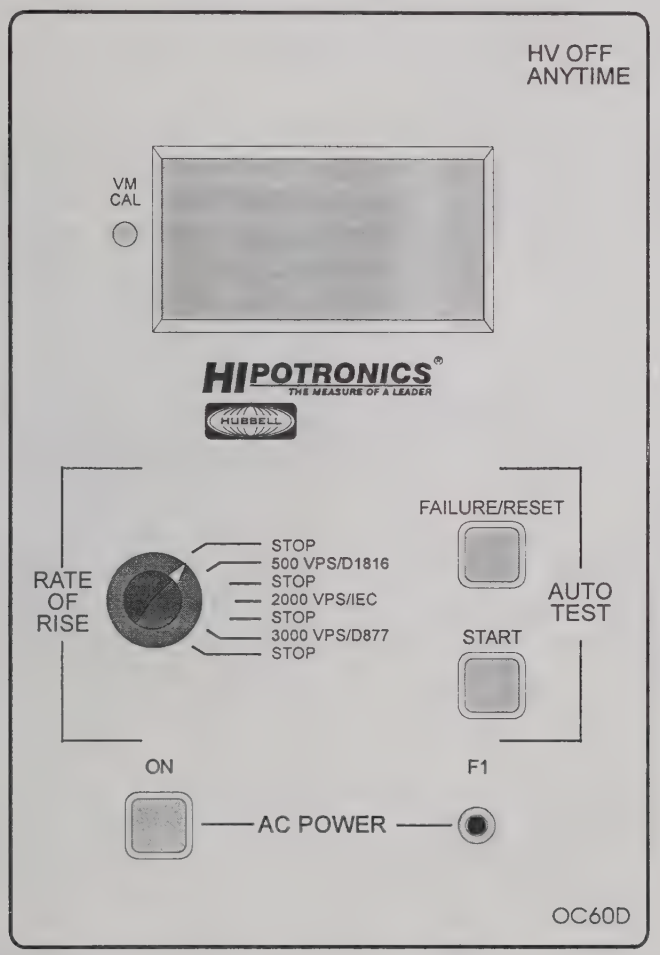


Figure 2 *Digital Oil Dielectric Test Set Front Panel*

Voltmeter

The **VOLTMETER** is located at the top of the front panel and indicates the ac output voltage in kilovolts, indicated by the label "ac kV" on the scale.

The **VOLTMETER** is certified accurate to 2 percent, and is provided with a memory feature. The memory feature causes the indicator to retain its settings at the breakdown voltage until manually reset, even after output voltage is deactivated.

Rate Of Rise Selector

Output voltage is regulated by means of the **RATE OF RISE** rotary selector. When the **START** pushbutton is pressed, the output voltage increases at a rate of 500, 2000, or 3000 volts per second, depending on the setting of the **RATE OF RISE** rotary selector. Turning the knob to the corresponding **STOP** setting for the selected voltage provides a manual dwell capability, maintaining the voltage output at the achieved level. To resume the application of voltage, turn the knob to the original rate of rise value selected.

Start Pushbutton

The **START** pushbutton is used to activate the output voltage. The voltage applied depends on the **RATE OF RISE** selector setting. Once the **START** pushbutton is pressed, voltage is applied continually until breakdown voltage is achieved, causing the red **FAILURE** indicator to light, or until the **HV OFF ANYTIME** interlock switch is released by opening the safety glass cover. The test may also be ended by pressing the **RESET** pushbutton.

Failure Indicator

When the breakdown voltage of the insulating liquid is reached, the **FAILURE** indicator lights and output voltage is automatically deactivated.

Reset Pushbutton

The **RESET** pushbutton is used to turn off the **FAILURE** indicator, reset the voltmeter to zero, and permit the resumption of testing. Output voltage can be reactivated following breakdown only by pressing the **START** pushbutton. Pressing the **RESET** pushbutton will also end an in-process test and reset all circuits to initial conditions.

AC Power Controls

The **AC POWER** section of the front panel contains an ON/OFF toggle switch, a pilot light to indicate that ac power is on, and a current limiting fuse. The current limiting fuse protects the unit and may be removed for replacement by pressing the black cap down while turning it counterclockwise.

HV OFF Anytime Switch

The application of high voltage may be terminated at any time by releasing the high voltage test cage interlock switch (above **HV OFF ANYTIME**). This is accomplished on the OC60D by sliding open the safety glass cover. On the OC90D, lifting the safety glass cover stops the application voltage by releasing the interlock switch.

Setting Up the Equipment

The digital series of oil dielectric test sets requires no special installation procedures. The units are shipped with the power cord and any test cells (oil cups) packed inside the test cage under the safety glass cover.

The procedure for setting up the unit prior to testing is as follows:

1. Remove packing material, power cord, test cells, and any other components from the test cage.
2. ***Ground the unit before connecting input power.*** The ground lug is located on the left side of the unit, below the plug receptacle.
3. Insert the socket end of the power cord into the receptacle on the left side of the unit and connect it to a suitable power source. ***If a two-prong adapter is used, be sure to ground the pigtail.***
4. Secure the desired quantity of the insulating liquid to be tested, and ensure that the temperature is between 20-30 degrees Centigrade (68-86 degrees Fahrenheit).
5. Wipe the electrodes and test cell clean with a dry, lint-free tissue paper or a clean, dry chamois.
6. To ensure conformity with ASTM Standards D877 or D1816, check and adjust the spacing of electrodes in the test cell using an appropriate gap gauge. Pre-tested gauges are supplied with Hipotronics test cells.
7. Rinse the electrodes and test cell thoroughly with a dry hydrocarbon solvent such as kerosene or Stoddard solvent.
8. After thorough cleaning, flush out the test cell with a filtered sample of the type of liquid to be tested.
9. Perform a breakdown test on a sample of the test liquid, following the procedures described in the section of this user's guide titled *Operating the Equipment*.
10. If the breakdown voltage of the sample is in the proper range for this type of liquid, proceed to Step 12. (Refer to manufacturer's specifications for breakdown range).
11. If the breakdown voltage of the sample liquid is *not* in the proper range, empty the test cell and repeat these instructions beginning with Step 5. If this test is also unsuccessful, repeat the instructions again from Step 5, using an insulating liquid at Step 9 with a breakdown voltage beyond question. If this breakdown test shows the proper range, reject the insulating liquid to be tested. If the test does *not* show the proper range, recalibrate the oil dielectric test set as described in the section of this user's guide titled *Performing Special Operations: Recalibration*.

12. Following a successful sample breakdown test, empty the test cell and refill it with a sample of the insulating liquid to be tested. Swirl the oil several times in the test cell to mix any impurities present with the oil, then empty the cup. The oil dielectric test set and test cell are now ready for testing as described in the section of this user's guide titled *Operating the Equipment*.

Operating the Equipment

This section provides step-by-step instructions for testing the breakdown voltage of insulating liquids. Prior to performing these tests, the procedures described in the section of this user's guide titled *Setting Up the Equipment* must be performed.

The procedure for operating the unit is as follows:

1. ***Ensure that the unit is properly grounded before connecting input power.*** The ground lug is located on the left side of the unit, below the plug receptacle.
2. Ensure that the power cord is properly plugged in as described in Step 3 of *Setting Up the Equipment.*
3. To ensure conformity with ASTM Standards D877 or D1816, check and adjust the spacing of electrodes in the test cell using an appropriate gap gauge. Pretested gauges are supplied with Hipotronics test cells.
4. Fill the test cell with a sufficient quantity of the insulating liquid to completely cover the electrodes, and to the minimum level specified in the appropriate ASTM Standard.
5. Swirl the insulating liquid by rocking the test cell *slowly*. (Rapid agitation may create an excess of air bubbles in the liquid).
6. Gently snap the filled test cell in place between the bushings of the transformer in the test cage and close the safety glass cover.
7. Before testing, allow the sample to stand for a minimum of three minutes to permit any accumulated air bubbles to escape. If a VDE test cell is used, plug the line cord into the receptacle on the left panel of the test cage.
8. Turn the **AC POWER** switch ON.
9. If the **FAILURE** indicator lights, press the **RESET** pushbutton until the voltmeter reading is at zero.
10. With the voltmeter reading zero, set the **RATE OF RISE** rotary selector to the appropriate setting.
11. Press the **START** pushbutton to activate the output voltage. Voltage is applied automatically at the specified rate until breakdown occurs, at which point the **FAILURE** indicator lights and the voltage is turned off.

    Note: The voltage may be terminated before breakdown by releasing the test cage interlock switch (**HV OFF ANYTIME**). This is accomplished by opening the safety glass cover. Also, voltage may be maintained at any level prior to breakdown by setting the **RATE OF RISE** selector to **STOP** (manual dwell).
12. The voltmeter continues to display the breakdown voltage until the **RESET** pushbutton is pressed. After reading and recording breakdown voltage, press the **RESET** pushbutton and allow the voltmeter to return to zero.

13. Perform repetitive breakdown tests beginning at Step 11, in accordance with statistical criteria described in the appropriate ASTM Standard.

Using the Optional OCPC Controller

The Hipotronics Model OCPC Automatic Controller is an *optional* product available for use with either model of the oil dielectric test set. It is designed to automatically test the dielectric strength of insulating liquids and print a test report according to ASTM test standards for D1816 and D877. In addition, test options for the IEC 156 standard and a user-definable test option are also available. The IEC 156 test sequence meets all of the standard's requirements except for the automatic agitation of the test sample between breakdowns. This function must be performed by the user to maintain strict compliance with the IEC 156 standard.

The programmable test option gives the user the ability to define a test sequence and pass/fail criteria. The report generated for each of the tests performed provides a space for the date, the user's name, and the test number. The printout includes individual breakdown voltages, the average breakdown voltage, the standard deviation, the ratio of the average to the standard deviation, and whether or not the sample passed the ratio criteria. Additional space is included at the bottom of the printout for data required to fulfill the standards' requirements for test reports. The OCPC operates from 115/220 V ac, 50/60 Hz. A power cord is included with each unit.

If you have *not* purchased the OCPC Automatic Controller, proceed to the section of this user's guide titled *Performing Special Operations* on Page 17.

OCPC Controls and Indicators

A diagram of the front panel of the OCPC Automatic Controller is displayed in Figure 3. Refer to this diagram, as well as to the front panel itself, when reading the description of the controls and indicators.

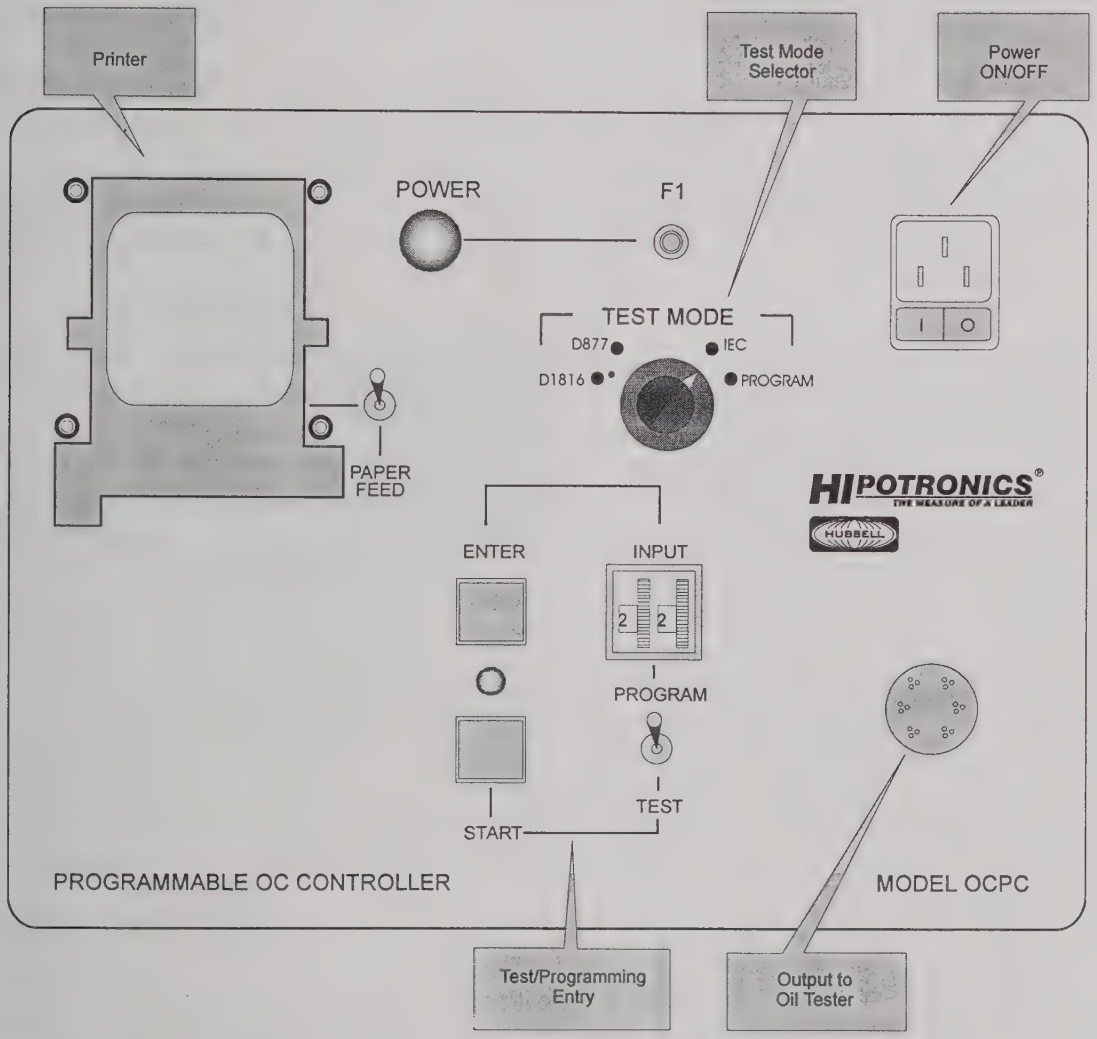


Figure 3 *OCPC Automatic Controller Front Panel*

AC Power Indicator

The AC input plug has a switch integrated into the case that serves as an ON/OFF power switch for the OCPC. The indicator to the left lights when power is activated. If this indicator fails to light, the fuse on the front panel may be removed for replacement by pressing the black cap down while turning it counterclockwise.

Test Mode Selector

The **TEST MODE** rotary selector determines which test the OCPC performs. The available options are the standard tests (D1816, D877, and IE 156) and the **PROGRAM** test mode, which allows the user to program a test sequence using the **INPUT** thumbwheel and the **ENTER** pushbutton. For further information about the programmable test, see the section of this user's guide titled *Operating the OCPC Controller: Programming.*

Input Thumbwheel and Enter Pushbutton

The **INPUT** thumbwheel and the **ENTER** pushbutton allow the user to program a test sequence. The **ENTER** pushbutton also initiates the calibration sequence. For further information about calibrating the OCPC, see the section of this user's guide titled *Performing Special Operations for the OCPC Controller: Calibrating.*

Test/Program Toggle Switch

The **TEST/PROGRAM** toggle switch is used in **PROGRAM** test mode to choose between the **TEST** and **PROGRAM** functions. In other test modes, this toggle switch has no function and can be set in either position. Selecting **TEST** instructs the OCPC to begin the test sequence programmed by the user. Selecting **PROGRAM** allows the user to program his own test parameters into the OCPC. For further information about the programmable test, see the section of this user's guide titled *Operating the OCPC Controller: Programming.*

Start Pushbutton and Test On LED

The **START** pushbutton initiates a test sequence. The OCPC performs a test according to the position of the **TEST MODE** selector. During a test, the red **TEST ON** LED (above the **START** pushbutton) lights to indicate a test is in progress. There is a 3-5 minute delay in each of the three standard tests, allowing the oil sample in the test cell to settle. ***Do not disturb the instrument during this time.*** When the test is complete, the OCPC prints the results and the **TEST ON** LED turns off.

Paper Feed Toggle Switch

The **PAPER FEED** toggle switch, located to the right of the paper tray, feeds paper through the printer automatically. Refer to the section of this user's guide titled *Performing Special Operations for the OCPC Controller: Maintaining the Printer.*

Setting Up the OCPC Controller

Note: Follow the setup procedures for the OC Series unit *before* performing a test with the OCPC.

The OCPC consists of the main control unit, an isolation interface box with a 5-foot shielded cable attached, and a 6-foot power cord. To install the unit, do the following:

1. Plug the interface box directly into the OC Series unit and connect the ground braid to the ground lug of the OC Series unit.
2. Plug the end of the interface box cable into the connector on the OCPC front panel.
3. Plug the power cord into an outlet.

Operating the OCPC Controller

This section provides step-by-step instructions for performing tests and programming the OCPC.

Testing

1. Select a test using the **TEST MODE** selector. If **PROGRAM** is selected, ensure that the **TEST/PROGRAM** toggle switch is set to **TEST**.
2. Select the desired rate of rise with the **RATE OF RISE** rotary selector on the OC Series unit.
3. Prepare an oil sample and place the test cell in the test cage of the OC Series unit. It is not necessary to allow the test sample to settle before proceeding because the OCPC will delay the test for the appropriate amount of time automatically.
4. Press the **START** pushbutton on the OCPC to activate the test cycle. The red **TEST ON** LED will light.

At the end of the test, the **TEST ON** LED turns off, the results of the test are printed, and a beeper sounds. The printed results will resemble the information displayed in Figure 4.

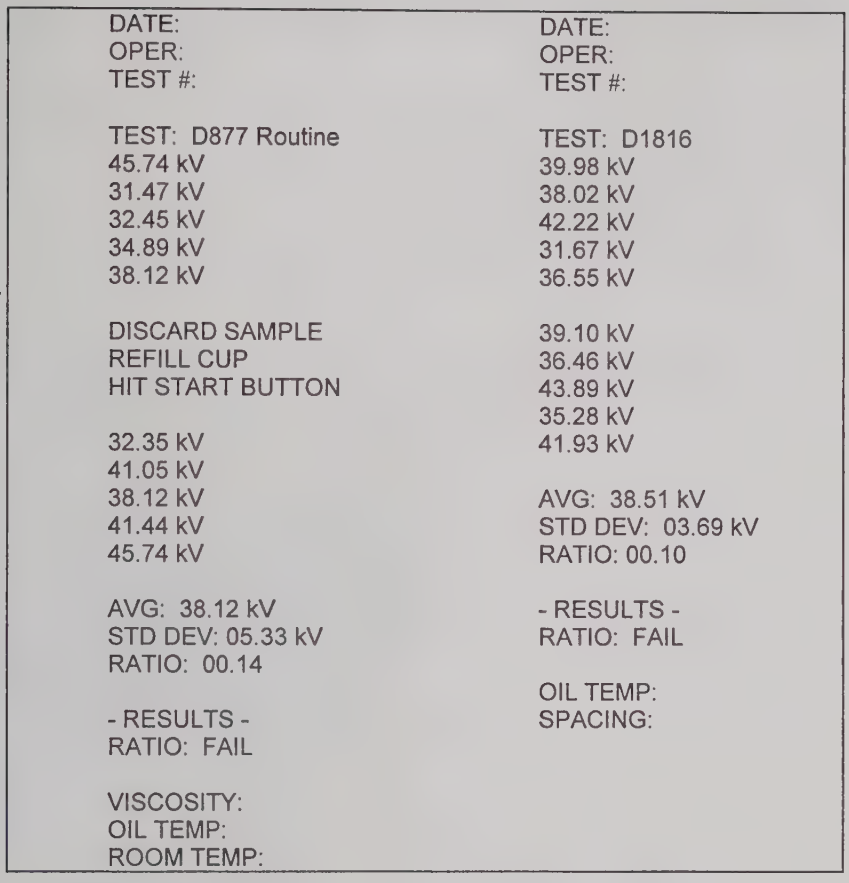


Figure 4 *OCPC Test Results*

Programming

User-defined dielectric test standards can be programmed from the front panel, using the **INPUT** thumbwheel and the **ENTER** pushbutton. The following parameters must be defined when programming a test:

Breakdowns per sample: This parameter refers to the number of times high voltage is to be applied to a single sample. Available range is from 00-99 breakdowns.

Initial settling time: This parameter defines the amount of time the OCPC delays between the press of the **START** button and the first application of voltage. Available range is from 0.0 - 9.9 minutes.

Time between breakdowns: This parameter defines the amount of time the OCPC waits between the time a breakdown occurs and the next application of high voltage. Available range is from 0.0 - 9.9 minutes.

Discard bad sample: This parameter defines whether or not a sample is discarded if it fails the dielectric test. If a sample is to be discarded, the OCPC will pause the test cycle and prompt the user to change the test sample and press the **START** pushbutton to resume the test. If this feature is not selected, the OCPC automatically continues with the test using the original sample in the test cell. To select this feature, enter any number other than ""00". Entering "00" disables this feature.

Ratio limit: This parameter is the pass/fail criteria. The ratio is defined as the division between the average value of the breakdown voltages and the standard deviation.

To begin programming, press the **START** pushbutton and wait for the OCPC to print instructions.

Note: Only two numbers can be used to enter values on the **INPUT** thumbwheel; therefore, the decimal point must be *assumed* when responding to the OCPC's printed requests for a time or a ratio limit. For example, a time value of 1 minute and 30 seconds (or 1.5 minutes) must be entered on the **INPUT** thumbwheel as **15**. A ratio limit of .01 must be entered on the INPUT thumbwheel as **01**.

The OCPC prints the following instruction to the printer:

Enter test specifications.
Breakdowns per sample
00-99

Dial in the desired value using the **INPUT** thumbwheel and press the **ENTER** pushbutton. The OCPC will print the number for verification. The OCPC then prints the following instruction to the printer:

Time between breakdowns
0.0 - 9.9 minutes

Dial in the desired value using the **INPUT** thumbwheel and press the **ENTER** pushbutton. The OCPC will print the number for verification. The OCPC then prints the following instruction to the printer:

Initial settling time
0.9 - 9.9 minutes

Dial in the desired value using the **INPUT** thumbwheel and press the **ENTER** pushbutton. The OCPC will print the number for verification. Note the range of acceptable inputs. The OCPC then prints the following instruction to the printer:

Discard bad sample
00 - No, Else - Yes

Dial in the desired response using the **INPUT** thumbwheel and press the **ENTER** pushbutton. Selecting "00" disables the **DISCARD BAD SAMPLE** feature. The OCPC will print the response for verification. The OCPC then prints the following instruction to the printer:

Ratio limit
.00 - .99

Dial in the desired value using the **INPUT** thumbwheel and press the **ENTER** pushbutton. The OCPC will print the number for verification. Note the range of acceptable input.

OCPC programming is now complete. To run the programmed test sequence, set the **TEST/PROGRAM** toggle switch to **TEST** and press the **START** pushbutton. This programmed sequence remains in memory until power is turned off or until another test sequence is programmed.

Performing Special Operations for the OCPC Controller

Calibration

This function allows the user to calibrate the **INPUT** thumbwheel and the voltmeter of the OCPC to an OC Series unit. It is important that the OC Series unit be in good working order and calibrated *before* running this procedure. For information about recalibrating the OC Series unit, see the section of this user's guide titled *Performing Special Operations: Recalibration.*

As part of this procedure applies high voltage to the test cell of the OC Series unit, preparation must be made for a high voltage test as described in the section of this user's guide titled *Setting Up the Equipment.* If **INPUT** thumbwheel calibration is to be performed, remove the four mounting screws on the left and right sides of the front panel and lift the controller out of the case.

The calibration procedure is as follows:

1. Set the **TEST MODE** selector to **PROGRAM** and press the **ENTER** pushbutton. The OCPC will print out a series of numbers that should match the reading on the **INPUT** thumbwheel. If the numbers do *not* match, adjust the **INPUT** thumbwheel potentiometer through the opening in the side of the chassis until the readings match. Try changing values of the **INPUT** thumbwheel and verify that the printout is accurate.

   Warning!! The following step automatically applies high voltage to the test cell. Ensure that the unit has been prepared for a high voltage test and that all safety procedures are followed.

2. Press the **ENTER** pushbutton again to initiate a high voltage test cycle in the OC Series unit. The OCPC will print the voltmeter readings. When the test cell reaches breakdown level and the digital meter on the OC Series unit holds its value, verify that the OCPC has printed out the correct reading. If the numbers do not match, adjust the voltmeter potentiometer through the opening in the front panel until the printout matches the value on the OC Series unit's digital meter.
3. Press the **ENTER** pushbutton a third time. The calibration sequence completes, the printer stops, and the OCPC is in a ready state.

Maintaining the Printer

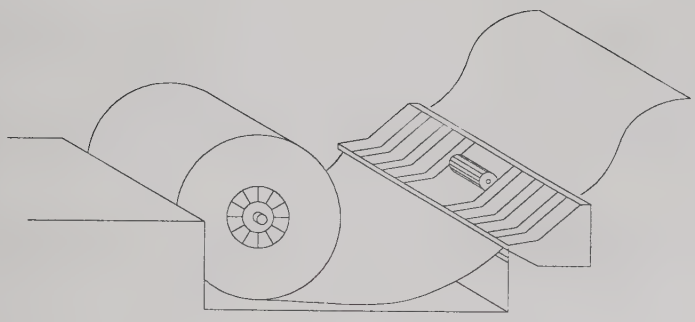
The paper used in the OCPC is a standard roll of adding machine paper that can be purchased at any stationery supplier. Paper specifications are: 57-58 mm wide, 0.06-0.085 mm thick, and 3 inches maximum roll diameter. The ribbon cartridge is Epson Part No. ERC-09.

To install a new roll of paper, do the following:

1. Remove the empty paper roll from the paper tray and place the new roll on the spool. Do not place the new roll in the paper tray.
2. Remove the ribbon cartridge from the printer by pressing on the right side of the cartridge.
3. Feed a smooth edge of the paper into the printer head until it reaches the small black roller.
4. Press the **PAPER FEED** toggle switch to feed the paper into the printer.
5. Place the spool in the paper tray and replace the ribbon cartridge.
6. Insert the edge of the paper between the ribbon and the plastic portion of the cartridge (see Figure 5).

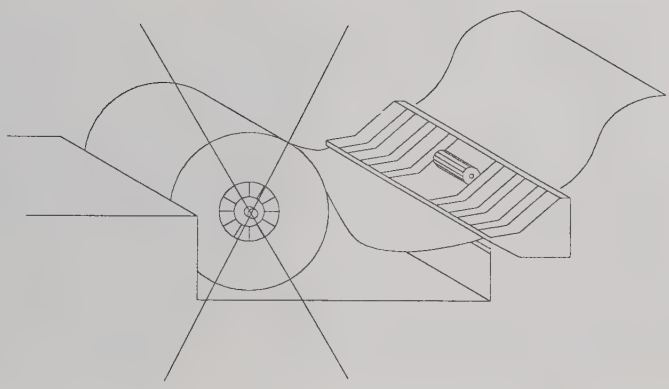
CORRECT

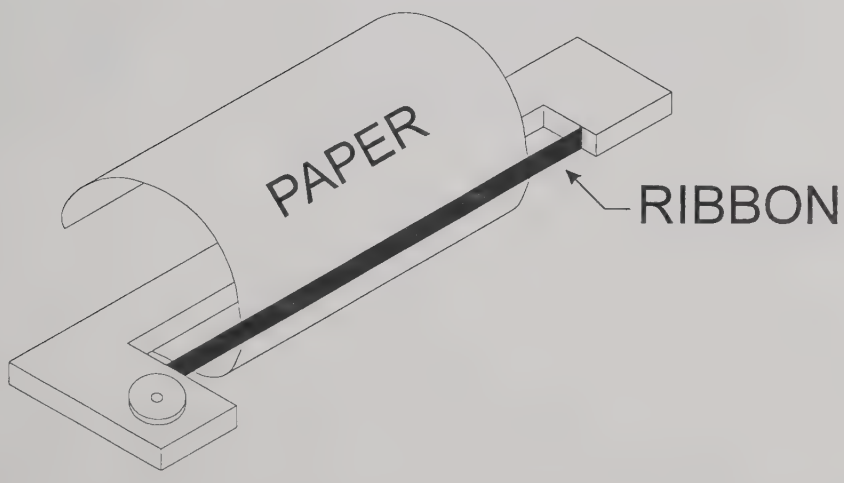
ALLOW PAPER TO FEED FROM BENEATH THE ROLL



INCORRECT

DO NOT ALLOW PAPER TO FEED OVER TOP OF ROLL





FEED PAPER BEHIND RIBBON

Figure 5 *Loading the Printer*

Performing Special Operations

The first part of this section describes the step-by-step procedures required to perform recalibration. The second part of this section provides suggestions for problem diagnosis and maintenance.

Special operations should be performed only by a trained technician, as they require access to the power supply (test cage) section of the unit where dangerously high voltage may exist.

Recalibration

Recalibration of OC Series units can be performed by the user. A calibration standard meter (Hipotronics Model OCCM) is an optional unit that inserts directly into the slot designed for the standard oil cup. This meter provides maximum convenience when recalibrating the voltmeter and reduces safety hazards. If the Hipotronics Model OCCM Calibrator is *not* used for recalibration, use a calibrated external voltmeter with a maximum meter range of approximately one-half of the unit's maximum output.

Hipotronics voltmeters have been calibrated with standards traceable to national standards maintained by the National Institute of Standards and Technology (NIST) in Washington, DC and are certified accurate to within 2 percent when shipped. Perform meter recalibration as often as necessary to meet the requirements of each particular installation, as dictated by usage and by standards for accuracy. Three factors influence the frequency of meter calibration: the amount of physical handling, time lapse, and extent of usage. Intervals between meter recalibration can vary from one month to one year.

The OC Series units contain four potentiometers used for calibration. One potentiometer is used to calibrate the voltmeter and the other three potentiometers are used to calibrate the rate of rise speed settings. The location of these potentiometers and procedures for their adjustment are included in the individual recalibration instructions.

Using the Model OCCM Calibrator (Optional)

The Hipotronics Model OCCM Calibrator is designed specifically for checking and recalibrating the oil dielectric test sets (Model OC60D at full scale and Model OC90D at 60 percent of full scale).

The OCCM Calibrator module fits directly into the high voltage output area of the OC60 series, replacing the test cell (oil cup). The module will also fit directly into the high voltage area of the OC90 units after fitting the two large brass adapters.

Installing the OCCM Calibrator and Testing Calibration

1. Ensure that the **AC POWER** switch is **OFF**.
2. Slide the Plexiglas safety door covering the oil cup compartment to the left and lift out the oil cup.
3. Insert the Model OCCM Calibrator module into the high voltage output slots vacated by the oil cup and slide the cover to the right. Ensure that the safety interlock switch is depressed.
4. Reconnect **AC POWER** to the test unit and activate the power.
5. Activate the high voltage by pressing the **START** pushbutton.
6. Record the tracking of the test unit's kilovoltmeter against the calibrator meter. Tracking should be line-for-line within ± 2 percent. If not, perform Step 7 (but do *not* remove the Calibrator), then proceed to the section of this user's guide titled *Preparing for Recalibration.*
7. Deactivate the high voltage, disconnect **AC POWER**, and remove the Calibrator.

Preparing for Recalibration

Before attempting to recalibrate the OC Series units, make the following preparations:

Voltmeter

1. Place the unit on a table or platform at a level that allows for maximum accuracy in readings.
2. Ensure that the **AC POWER** switch and **RATE OF RISE** selector are **OFF**.
3. ***Ground the unit before connecting input power.*** The ground lug is located on the left side of the unit, below the plug receptacle.
4. If the Model OCCM Calibrator is used for calibration, proceed to the section of this user's guide titled *Recalibrating the Voltmeter*. Otherwise, continue with Step 5.
5. Remove the three screws along the front top edge of the unit. These screws secure the track in which the safety glass cover slides. Remove the track and the safety glass cover.

   Caution: The high voltage area is exposed when the safety glass cover is removed.

Rate of Rise

1. Place the unit on a table or platform at a level that allows for maximum accuracy in readings and will allow space to rest the left panel next to the unit.
2. Ensure that the **AC POWER** switch and **RATE OF RISE** selector are **OFF**.
3. ***Ground the unit before connecting input power.*** The ground lug is located on the left side of the unit, below the plug receptacle.
4. Remove the screws attaching the left panel to the unit. There are nine screws: three on the left side of the front panel, two on each side of the side panel, and two on the bottom of the side panel.
5. Insert the power cord plug into the side panel receptacle. Set the side panel (outer side down) across the power cord on the table. The top edge of the panel should face the rear of the unit to avoid pulling the wires leading from the inner portion of the receptacle.

Recalibrating the Voltmeter

Note: Proceed only if the preparation procedures for recalibrating the voltmeter (Page21) have been performed.

1. Connect the power cord to a suitable source. ***If a two-prong adapter is used, be sure to ground the pigtail.***
2. If the Model OCCM Calibrator is being used, proceed to Step 6. If other equipment is being used, proceed with Step 3.
3. Connect the low side (ground) of a calibrated external voltmeter to the ground lug on the left side of the unit's panel. The external voltmeter should have a maximum meter range of approximately one-half of the unit's maximum output (because the high voltage transformer in these units has a grounded center tap, only one-half of the rated voltage is applied to each output bushing).
4. Separate the two bushings inside the test cage with insulation to prevent arcing when voltage is applied.
5. Using a connector with heavily insulated wire, connect one bushing inside the test cage to the high side of the external voltmeter. (Hipotronics's Quality Control Department tests both bushings before shipping. These procedures require testing only one bushing, as it is considered highly unlikely that the voltage output of the bushings will differ).
6. Turn the **AC POWER** switch ON.
7. Determine the calibration value (voltage readings) to be measured. It is suggested that approximately two-thirds of the unit's capacity be used as the calibration value; for example, 40 kV for Model 0C60D and 60 kV for Model OC90D.
8. Turn the **RATE OF RISE** selector to the **500 VPS** setting.
9. Activate output voltage by pressing the **START** pushbutton.
10. Turn the **RATE OF RISE** selector to the appropriate **STOP** setting as soon as the reading on the external meter equals one-half of the calibration value determined in Step 7. For example, if the suggested value of 40 kV is used when calibrating the Model OC60D, turn the **RATE OF RISE** selector to **STOP** when the external meter reading reaches 20 kV.
11. Check the reading on the unit meter. If the unit meter reading does not equal the calibration value determined in Step 7, the meter calibration potentiometer labeled **VM CAL** on the front panel must be adjusted. Turn the **VM CAL** potentiometer *slowly* with an insulated screwdriver until the voltmeter reading reaches the desired number.
12. Turn the **AC POWER** switch to **OFF** and the **RATE OF RISE** selector to **STOP**. Calibration is now complete.

13. Reinstall the track and safety glass cover. Slide the cover all the way to the right and ensure that the test cage interlock switch comes up through the notched corner of the safety glass.

Recalibrating the Rate of Rise

Note: Proceed only if the preparation procedures for recalibrating the rate of rise (Page21) have been performed. It is recommended that the voltmeter be recalibrated before the rate of rise calibration is performed.

1. Connect the power cord to a suitable source. ***If a two-prong adapter is used, be sure to ground the pigtail.***
2. Turn the **AC POWER** switch ON.
3. Set the **RATE OF RISE** selector to a speed setting that will be calibrated. All speed settings must be recalibrated separately, but may be recalibrated in any order.
4. Press the **START** pushbutton and measure the time it takes to advance from 10 kV to the final value shown in Figure 5, using an accurate timer such as a stop watch or a watch with a sweep-second hand.
5. Compare the measured time with that in Figure 6 and adjust the appropriate potentiometer with an insulated screwdriver. Rate of rise speed setting potentiometers are located on the Printed Circuit Board (PCB) assembly and are labeled **LOW** and **HIGH** to indicate the related setting.

RATE OF RISE	FINAL VALUE (kV)	Time(s)	Potentiometer
500	20	20	R1
2000	30	10	R2
3000	40	10	R28

Figure 6 *Rate of Rise Times and Values*

6. Turn the **AC POWER** switch **OFF** and the **RATE OF RISE** selector to **STOP**. Calibration is now complete and the unit may be reassembled.

Diagnosing Problems

All products shipped by Hipotronics are thoroughly tested against a rigid set of standards by the firm's Quality Control Department. If a unit does not function properly upon delivery, refer to the section titled *Returned Material* at the end of the user's guide.

This section is intended to help the user *locate* the source of a problem when the OC Series unit is not functioning or is functioning improperly. The procedures described should be performed by a trained repair technician and are not recommended for individuals trained only to operate the equipment. It is not recommended that repairs be

performed while the equipment is under Warranty, as some of the recommended steps may void the Warranty. Contact Hipotronics's Service Department for further information.

Note: Do not attempt to repair the OC90D units. Contact Hipotronics's Service Department to correct problems with these units.

Figure 7 lists the most frequently encountered problems, with possible causes and corrective actions. If a more complex problem arises, the enclosed schematics should provide the experienced technician with additional information. See the enclosed *Parts List* to obtain part numbers for all components listed.

PROBLEM	POSSIBLE CAUSE/CORRECTIVE ACTION
No high voltage output	• Fuse blown; replace fuse. • Low input voltage. connect to suitable voltage source. • Variac (T1) damaged. Replace if necessary. • Motor advances but variac (T1) doesn't. Realign motor shaft with variac and tighten down shaft.
Erratic high voltage	• Variac brushes are worn or dirty. Clean or replace brushes.
Incorrect voltmeter reading	• Recalibrate to a standard meter.
High voltage rises at same speed regardless of rate of rise selected	• IC-1 faulty. Replace.
Failure light indication not consistent with normal mode of operation.	• Faulty SCR-1 on the relay circuit board. Replace.
Motor will not run.	• IC-1 faulty. Replace. • IC-2 faulty. Replace. • IC-3 faulty. Replace. • Check for 12 V on power supply board and replace voltage regulator chip, if necessary.

Figure 7 *Diagnosing Problems*

Performing Maintenance

Cleaning the Equipment Surfaces

Clean the front panel with a damp cloth and a mild detergent, ensuring that the solution does not come in contact with the electrical circuitry. Clean meter faces with a residue-free, commercial grade glass cleaner.

Maintaining Electrodes and Test Cells

Maintenance procedures for electrodes and test cells are described in the ASTM Standard D877 or ASTM Standard D1816.

Warranty

HIPOTRONICS®
THE MEASURE OF A LEADER

HIPOTRONICS, INC. warrants to the original purchaser of any new merchandise that the merchandise is free from defects in materials and workmanship under normal use and service for a period of one (1) year from the date of shipment. The obligation of Hipotronics, Inc. under this warranty is limited, in its exclusive option, to repair, replace or issue credit for parts or materials which prove to be defective, and is subject to Purchaser's compliance with the Hipotronics, Inc. Warranty Claim Procedure as set forth below. The happening of any one or more of the following events will serve to void this warranty and any defect or damage resulting therefrom is specifically excluded from Warranty coverage:

(a) defects due to accident, negligence, alteration, modification, faulty installation, abuse or misuse by Purchaser or Purchaser's agents or employees.

(b) attempted or actual dismantling, disassembling, service or repair by any person, firm or corporation not specifically authorized in writing by Hipotronics, Inc.

(c) defects caused by or due to handling by carrier or incurred during shipment, transshipment or other move.

This Warranty covers only those parts and/or materials deemed by Hipotronics, Inc. to be defective within the meaning of this Warranty. The liability of Hipotronics, Inc. shall be limited to the repair, replacement or issuance of credit for parts deemed defective within the meaning of this Warranty. Costs incurred by purchaser for labor or other expenses incidental to the inspection, repair, replacement or issuance of credit for such parts and/or materials shall be the sole responsibility of purchaser. This Warranty shall not apply to any accessories, parts or materials not manufactured or supplied by Hipotronics, Inc. and if, in the sole discretion of Hipotronics, Inc., Purchaser's claim relates to any materials of a component part, or of the manufacturer of a device of which the defective part is a component, Hipotronics, Inc. reserves the right to disclaim liability under this Warranty and to direct that the Purchaser deal directly with such supplier or manufacturer. Hipotronics, Inc. agrees to assist the purchaser in processing or settling any such claim without prejudicing its position as to liability.

Warranty Claim Procedure

Compliance with the following Warranty Claim Procedure is a condition precedent to the obligation of Hipotronics, Inc. under this Warranty.

(a) Purchaser must notify Hipotronics, Inc. in writing by certified or registered mail, of the defect claimed within twelve (12) months after the date of original shipment. Said notice shall describe in detail the defect, the defective part and the alleged cause of the defect.

(b) At the exclusive option of Hipotronics, Inc., Purchaser shall dismantle or disassemble at Purchaser's cost and expense and shall ship the defective part or material, prepaid, to Hipotronics, Inc., Brewster, New York 10509, for inspection, or permit an authorized service representative of Hipotronics, Inc. to inspect the defective part or material at the Purchaser's premises. Purchaser shall provide facilities for, and at Purchaser's cost and expense, dismantle, disassemble, or otherwise make accessible the subject part or material whether or not same is a component of, or installed in, a device other than that manufactured or supplied by Hipotronics, Inc. If disclosure shows that the defect is not one for which Hipotronics, Inc. is liable, the Purchaser agrees to reimburse Hipotronics, Inc. for all expense incurred.

(c) Upon receipt of the defective part or material, or after access to same, Hipotronics, Inc. shall inspect the part or material to determine the validity of Purchaser's claim.

The validity of any Warranty Claim, Purchaser's compliance with Hipotronics, Inc. Warranty Claim Procedure, the obligation to either repair, replace or issue credit, or direct the purchaser to deal directly with a manufacturer or supplier are to be determined solely and exclusively by Hipotronics, Inc. any determination so made shall be final and binding.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED ON THE PART OF HIPOTRONICS, INC., INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND CONSEQUENTIAL DAMAGES ARISING FROM ANY BREACH THEREOF AND HIPOTRONICS, INC. NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON, FIRM OR CORPORATION TO ASSUME ANY LIABILITY OR OBLIGATION IN CONNECTION WITH THIS SALE ON ITS BEHALF AND PURCHASER ACKNOWLEDGES THAT NO REPRESENTATIONS EXCEPT THOSE MADE HEREIN HAVE BEEN MADE TO PURCHASER.

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Warranty

Returned Material

If it should become necessary to return the equipment described in this publication to the factory, the Service Department of HIPOTRONICS, INC. must be contacted at (914) 279-8091. If the return of the unit is appropriate, a Return Authorization Number will be issued and you will be instructed as to the method of return. If return of the unit is *not* advisable, other inspection arrangements will be made.

Please have the following information available to help our service personnel identify the unit and determine the necessity for return.

Note: **Material received at this plant without the proper authorization shall be held as "customer's property" and no service will be performed until the proper steps have been taken. Your cooperation is requested in order to ensure prompt service.**

MODEL: _____

SERIAL NUMBER: _____

TYPE (Part Number): _____

(The MODEL, SERIAL NUMBER and TYPE are indicated on the black and silver tag affixed to the unit.)

REASON FOR RETURN: _____

_____

_____

DEFECT: _____

_____

_____

Replacement Parts

To order replacement parts for this unit, please refer to the Parts List provided with this publication. Provide the number of the specific component along with the *type* (Part Number) of the unit, which is indicated on the Parts List and on the black and silver tag affixed to the unit.

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